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3D Printed Microwave Hyperthermia Applicator

Umar Hasni
Virginia Commonwealth University

Christopher Deloglos
Virginia Commonwealth University

Patricia Moseh
Virginia Commonwealth University

Team Members:
Umar Hasni,
Christopher Deloglos,
Patricia Moseh

Faculty Advisers:
Dr. Afroditi V. Filippas,
Dr. Erdem Topsakal

MULTIDISCIPLINARY

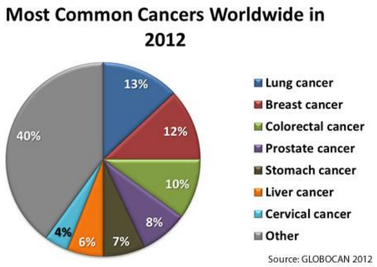
3D Printed

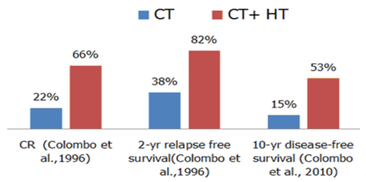
Microwave Hyperthermia Applicator

CAPSTONE DESIGN EXPO 2016

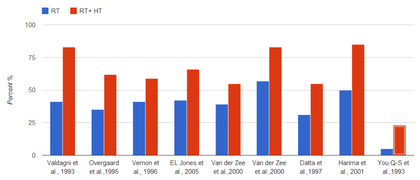
The Problem

According to the CDC, every year approximately two million people were diagnosed with some type of cancer in the United States alone.





Chemotherapy coupled with Hyperthermia



Radiation-therapy coupled with Hyperthermia

Common Cancer Treatments

- Surgery
- Chemotherapy
- Radiation Therapy
- Targeted Therapy
- Immunotherapy

Other Procedures & Techniques

- Stem Cell Therapy
- Hyperthermia → **Our Focus**
- Photodynamic Therapy
- Blood Product Donation & Transfusion
- Lasers in Cancer Treatment

Current Hyperthermia Applicators

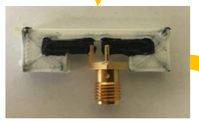
- **Expensive**
- **Bulky**
- **Complex System**
- **Heats Entire Body**
- **Low-Efficiency**
- **Non-Conformal**

Goal

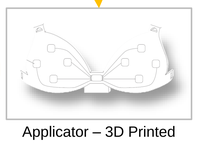
Develop a cost-effective, efficient hyperthermia applicator that can be tailored to specific patient needs and can offer targeted cancer treatment.

Additive Manufacturing

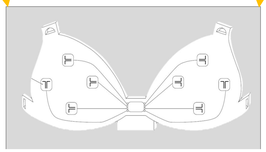
New Material Development



Antenna – 3D Printed



Applicator – 3D Printed

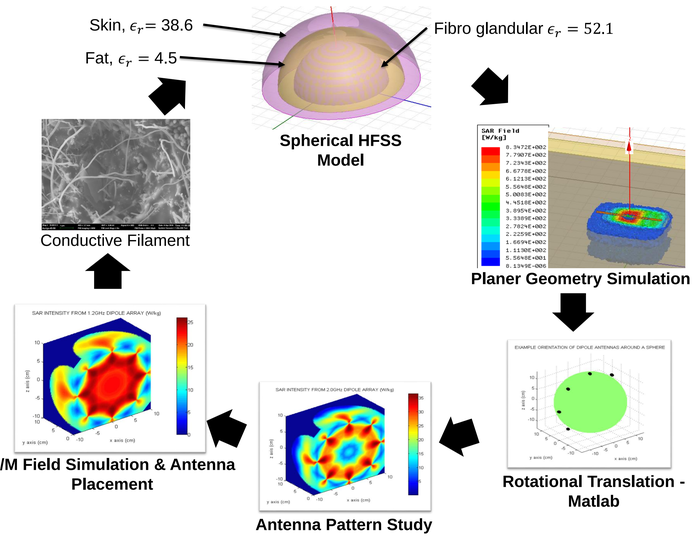


Microwave Hyperthermia Applicator

- **Tailored to Patient**
- **Streamlined**
- **Improved Efficiency**
- **Organ Specific**
- **Low Cost**

Research & Design

Bio-mimicking gels were developed and characterized using a Keysight network analyzer. Microwave antenna response of the breast tissues was characterized.



Approach & Innovation

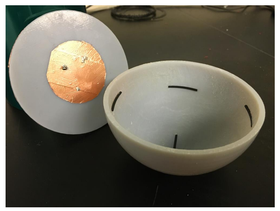
- **HFSS – Antenna Design & Simulation** → **Matlab – Antenna Pattern Study**
- **3D Conductive Filament Study** → **3D Filament Development**

→ **Fabrication & Testing with Bio-mimicking Gels**

Conclusion – The Product

Development of a cost-effective Product for including Microwave Hyperthermia as part of regular Breast Cancer diagnostics and care.

Development of a microwave hyperthermia protocol that can be modified for various types of cancers



VCU School of Engineering

Make it real.

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